SUPPLEMENTARY MATERIAL.

Supplementary Table 1. Association of mother genotype with mother deodorant usage. Contingency table showing genotypic frequencies of rs17822931 (GG + GA vs AA) observed in each category of deodorant usage in white mothers in ALSPAC. Expected numbers are in brackets and contribution to the overall chi-square, in italics.

	GG + GA	AA
never	235 (250.4) *0.95*	20 (4.6) *51.67*
<1 per week	82 (86.4) *0.23*	6 (1.6) *12.30*
about 1 per week	86 (88.4) *0.06*	4 (1.6) *3.49*
most days	821 (833.7) *0.19*	28 (15.3) *10.56*
daily	5154 (5119.1) *0.24*	59 (93.9) *12.98*

Chi-square = 92.66, 4 degrees of freedom, 2-sided p-value = 3.6×10^{-19}

Supplementary Table 2. Association of child genotype with mother deodorant usage. Contingency table showing genotypic frequencies of rs17822931 (GG + GA vs AA) in white children in ALSPAC and white mother's deodorant usage. Expected numbers are in brackets and contribution to the overall chi-square, in italics.

	GG + GA	AA
never	272 (275.3) *0.04*	8 (4.7) *2.37*
<1 per week	85 (83.6) *0.02*	0 (1.4) *1.42*
about 1 per week	123 (123.9) *0.01*	3 (2.1) *0.38*
most days	893 (897.8) *0.03*	20 (15.2) *1.49*
daily	5640 (5632.4) *0.01*	88 (95.6) *0.60*

Chi-square = 6.37, 4 degrees of freedom, 2-sided p-value = 0.173

Supplementary Table 3. Association of child genotype with partner deodorant usage. Contingency table showing genotypic frequencies of rs17822931 (GG + GA vs AA) in white children in ALSPAC and white white partners' deodorant usage. Expected numbers are in brackets and contribution to the overall chi-square, in italics.

	GG + GA	AA
never	528 (532.6) *0.04*	13 (8.4) *2.46*

<1 per week	169 (170.3) *0.01*	4 (2.7) *0.63*
about 1 per week	230 (227.4) *0.03*	1 (3.6) *1.88*
most days	1204 (1203.9) *0.00*	19 (19.1) *0.00*
daily	3231 (3227.8) *0.00*	48 (51.2) *0.20*

Chi-square = 5.25, 4 degrees of freedom, 2-sided p-value = 0.263

Supplementary Table 4. Association of mother genotype with partner deodorant usage. Contingency table showing genotypic frequencies of rs17822931 in white mothers in ALSPAC and white partners' deodorant usage. Expected numbers are in brackets and contribution to the overall chi-square, in italics.

	GG	GA	AA
never	358 (349.2) *0.22*	92 (101.5) *0.89*	9 (8.3) *0.06*
<1 per week	119 (117.9) *0.01*	33 (34.3) *0.05*	3 (2.8) *0.01*
about 1 per week	176 (174.2) *0.02*	49 (50.7) *0.05*	4 (4.1) *0.00*
most days	837 (846.0) *0.10*	255 (246.0) *0.33*	20 (20.1) *0.00*
daily	2304 (2306.7) *0.00*	674 (670.6) *0.02*	54 (54.7) *0.01*

Chi-square = 1.78, 8 degrees of freedom, 2-sided p-value = 0.987

Supplementary Table 5. Association of mother genotype with partner deodorant usage. Contingency table showing genotypic frequencies of rs17822931 (GG + GA vs AA) in white mothers in ALSPAC and white partners' deodorant usage. Expected numbers are in brackets and contribution to the overall chi-square, in italics.

	GG + GA	AA
never	450 (450.7) *0.00*	9 (8.3) *0.06*
<1 per week	152 (152.2) *0.00*	3 (2.8) *0.01*
about 1 per week	225 (224.9) *0.00*	4 (4.1) *0.00*
most days	1092 (1091.9) *0.00*	20 (20.1) *0.00*
daily	2978 (2977.3) *0.00*	54 (54.7) *0.01*

Chi-square = 0.09, 4 degrees of freedom, 2-sided p-value = 0.999

Supplementary Table 6: Putative confounders and their association with maternal and child genotype

		Maternal genotype				Child genotype			
		GG	GA	AA	p	GG	GA	AA	p
Maternal Age	<25	1332 (21.9)	371 (21.4)	29 (18.0)	0.630	1330 (20.2)	373 (19.5)	34 (21.1)	0.794
	25-29	2416 (39.7)	713 (41.2)	68 (42.2)		2547 (38.6)	770 (40.2)	62 (38.5)	
	30+	2342 (38.5)	648 (37.4)	64 (39.8)		2717 (41.2)	773 (40.3)	65 (40.4)	
Maternal Education	Low	1610 (29.0)	451 (28.5)	40 (27.4)	0.845	1623 (26.5)	462 (26.1)	44 (29.7)	0.741
	Medium	1948 (35.1)	570 (36.0)	48 (32.9)		2168 (35.4)	609 (34.4)	49 (33.1)	
	High	1996 (35.9)	563 (35.5)	58 (39.7)		2339 (38.2)	700 (39.5)	55 (37.2)	
Paternal Social Class	I+II	2202 (44.5)	636 (44.9)	63 (49.2)	0.687	2560 (46.3)	774 (48.7)	63 (49.6)	0.539
	III	2107 (42.6)	586 (41.4)	48 (37.5)		2290 (41.5)	632 (39.7)	49 (38.6)	
	IV+V	641 (12.9)	195 (13.8)	17 (13.3)		674 (12.2)	184 (11.6)	15 (11.8)	
Housing Tenure	Owned	4374 (75.7)	1253 (76.7)	123 (80.4)	0.588	4840 (77.1)	1435 (78.2)	115 (77.2)	0.608
	Council	763 (13.2)	213 (13.0)	16 (10.5)		758 (12.1)	210 (11.4)	14 (9.4)	
	Other	643 (11.1)	167 (10.2)	14 (9.2)		680 (10.8)	191 (10.4)	20 (13.4)	
Hygiene	Low	1327 (28.9)	359 (27.4)	40 (35.4)	0.315	2258 (38.4)	649 (37.9)	55 (40.1)	0.838
	Medium	1657 (36.0)	479 (36.6)	32 (28.3)		1169 (19.9)	358 (20.9)	24 (17.5)	
	High	1615 (35.1)	470 (35.9)	41 (36.3)		2446 (41.6)	705 (41.2)	58 (42.3)	

Hygiene of the mother and partner was estimated in two different ways. For the mother, how often she washed the child (face, hands and body) was used, while for the partner, how often he helped with washing clothes, dinner ware and utensils. No data were available on how often the parents washed themselves. The cumulative impact of these factors on unadjusted results was minimal eg see Table 2. Table entries for each genotype reflect N (%).

Supplementary Table 7. Association of mother genotype with mother deodorant usage (non whites). Contingency table showing non-white mother's deodorant usage and rs17822931 genotype in non-white mothers in ALSPAC. Expected numbers are in brackets and contribution to the overall chi-square, in italics.

	GG	GA	AA
never or <1 per week	5 (14.3) *6.02*	10 (6.4) *2.05*	8 (2.4) *13.58*
> 1 per week	80 (70.7) *1.21*	28 (31.6) *0.41*	6 (11.7) *2.74*

Chi-square = 26.03, 2 degrees of freedom, 2-sided p-value = 0.2×10^{-5}

Supplementary Table 8. Association of child genotype with mother deodorant usage (non whites). Contingency table showing non-white mother's deodorant usage and rs17822931 genotype in non-white children in ALSPAC. Expected numbers are in brackets and contribution to the overall chi-square, in italics.

	GG	GA	AA
never or <1 per week	19 (26.7) *2.22*	10 (8.3) *0.33*	8 (2.0) *18.61*
> 1 per week	199 (191.3) *0.31*	58 (59.7) *0.05*	8 (14.0) *2.60*

Chi-square = 24.12, 2 degrees of freedom, 2-sided p-value = 0.6×10^{-5}

Supplementary Table 9. Association of child genotype with partner deodorant usage (non whites). Contingency table showing non-white partners' deodorant usage and rs17822931 genotype in non-white children in ALSPAC. Expected numbers are in brackets and contribution to the overall chi-square, in italics.

	GG	GA	AA
never or <1 per week	22 (28.9) *1.63*	15 (12.3) *0.61*	7 (2.9) *5.87*
> 1 per week	98 (91.2) *0.52*	36 (38.7) *0.19*	5 (9.1) *1.86*

Chi-square = 10.67, 2 degrees of freedom, 2-sided p-value = 0.005

Supplementary Table 10. Association of mother genotype with partner deodorant usage (non whites). Contingency table showing non-white partners' deodorant usage stratified by rs17822931 genotype in non-white mothers in ALSPAC. Expected numbers are in brackets and contribution to the overall chi-square, in italics.

	GG	GA	AA
never or <1 per week	12 (15.9) *0.96*	8 (7.1) *0.12*	6 (3.0) *2.91*

> 1 per week	51 (47.1) *0.32*	20 (20.9) *0.04*	6 (9.0) *0.98*

Chi-square = 5.34, 2 degrees of freedom, 2-sided p-value = 0.069

Supplementary Figure 1. Deviations from Hardy-Weinberg proportions and analysis of ascertainment bias in white mothers for rs17822931.

Hardy-Weinberg equilibrium calculator including analysis for ascertainment bias

Chi-sq Hardy-Weinberg equilibrium test calculator for biallelic markers (SNPs, indels etc), including analysis for ascertainment bias for dominant/recessive models (due to biological or technial causes)
Enter observed counts for each genotype, then click "Calculate". (Copyright TRG, SR, INMD, 2008)

If you use this web-tool please cite:
Santiago Rodriguez, Tom R. Gaunt and Ian N. M. Day.
Hardy-Weinberg Equilibrium Testing of Biological Ascertainment for Mendelian Randomization Studies.
American Journal of Epidemiology Advance Access published on January 6, 2009, DOI 10.1093/aje/kwn359.

Common homozygotes 5884 Heterozygotes 1646 Rare Homozygotes 134

Calculate Reset

Result

X^2 = 2.3
(7664 samples counted)
for likelihoods of calculated X^2 value see below.

Genotype	Expected	Observed
Common homozygotes	5869.5	5884
Heterozygotes	1675	1646
Rare homozygotes	119.5	134

p allele freq = 0.88; q allele freq = 0.12

Solutions for perfect HWE, under a model of ascertainment (+/-) of one group

Group affected	Common Hz	Heterozygotes	Rare Hz	p allele freq	q allele freq
Common Hz	5054.69	1646	134	0.86	0.14
Heterozygotes	5884	1775.9	134	0.87	0.13
Rare Hz	5884	1646	115.11	0.88	0.12

(all results rounded to 2 decimal places)

Chi-squared distribution (1 degree of freedom):

P value	0.05	0.01	0.005	0.001
Chi-squared	3.84	6.63	7.88	10.83

Explanation of results

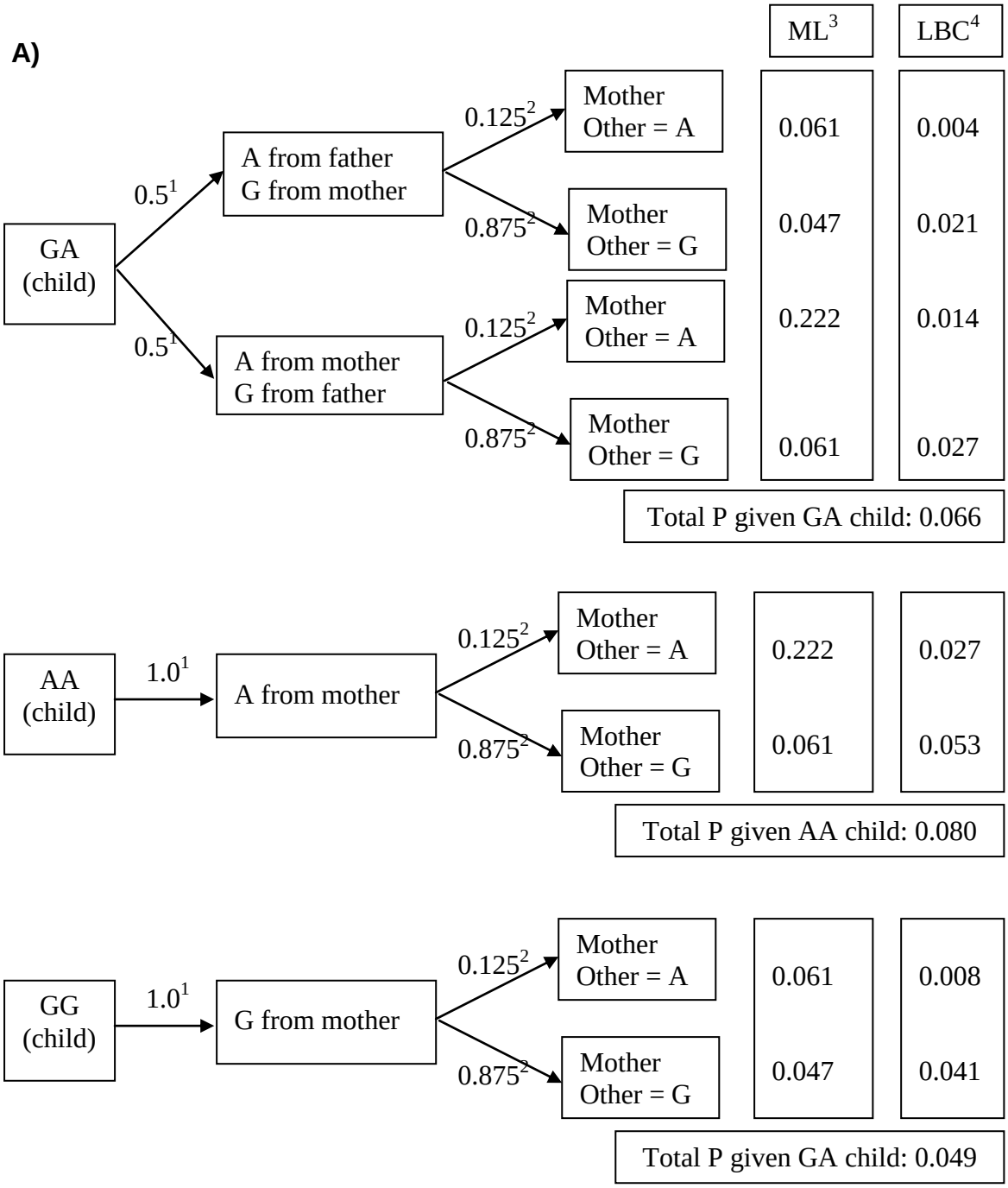
Three cases are presented (one in each row of the second results table), each representing missingness of one of the three genotype groups. For example, line 1 shows the potential missingness or otherwise of the common homozygote group; the number in red represents the number of common homozygotes expected under Hardy-Weinberg equilibrium **if** the other two groups are *assumed to be correct*. The same applies for the rows representing each of the other two genotype groups. Which row you select depends on your knowledge of the genotypes, and which group you may expect to be under or over represented.
Note that total number of genotypes does not necessarily equal the observed number. In each case the number in red has been adjusted to the *expected* number under Hardy-Weinberg equilibrium, given the *observed* numbers for the other two groups.

Notes

- X^2 refers to chi-squared
- The X^2 value indicates the difference between expected and observed values for genotype counts
- The likelihood of observing these differences by chance can be determined from a X^2 table (1 d.f.), a brief example of which is above
- Ascertainment bias (biological or technical reasons) may cause gains or losses in observed counts. This calculator indicates the expected counts under HWE if gains or losses have occured in one genotype group (dominant/recessive model) in addition to the conventional analysis which distributes gains/losses across all three genotype groups

Supplementary Figure 2. Prediction of deodorant usage based on child genotype. A) Predictions of children rs17822931 genotype were based on parents' genotypes, allele frequency and the likelihood of being a deodorant non user (<1 per week). B) There is a good agreement between the observed likelihood of mother's deodorant usage for child genotypes and mother's likelihood of deodorant usage predicted from child genotype.

A)



[1] Chances for a shared allele between mother and child
[2] Chances for mother's other allele
[3] Mother's likelihood of being a deodorant non user (<1 per week). (Based on Table 2)
[4] Likelihood of maternal deodorant usage based on child genotype (e.g, first row 0.5x0.125x0.061=0.004).

B)

	GG	GA	AA
Observed mother's deodorant usage for child genotypes	0.047	0.063	0.067
Mother's likelihood of deodorant usage predicted from child genotype	0.049	0.066	0.080

Appendix 1

Detailed Results

Regression analyses

Table 1 shows regression results between maternal and child rs17822931 and deodorant usage in ALSPAC parents, both for white and for non-white participants. Under the additive model, there was a strong association between deodorant usage and maternal rs17822931 genotype for white mothers B=-0.37, 95%CI(-0.47,-0.28), ($P=1.8x10^{-14}$) and for non-white mothers B=-1.52, 95%CI(-2.12,-0.92), ($P=1.5x10^{-6}$). However, there was no association between maternal genotype and partners' deodorant usage in whites (P=0.9040). The rs17822931 genotype in children associated with similar effect sizes for deodorant usage by the mother and by the partner. When considering white individuals, rs17822931 genotype of the child associated significantly with maternal deodorant usage B=-0.16, 95%CI(-0.25,-0.06), (P=0.0004) and with use of deodorant by partner B=-0.16, 95%CI(-0.30,-0.02), (P=0.0235).

Under the recessive model, the P values were comparable to the P values observed under the additive model for whites with the exception of the absence of the association of rs17822931 genotype in children with deodorant usage by the mother and the partner (Table 1). Most notably, maternal deodorant usage was very strongly associated with genotype under the recessive model B=-1.64, 95%CI(-1.98,-1.31), ($P=1.8x10^{-21}$).

Five other putative confounders were considered in linear regression analysis of maternal deodorant use on maternal genotype (Table 2). Significant associations were observed for four of them (maternal age, maternal education, housing tenure and hygiene), with no significant effect for paternal social class. The relative effect of rs17822931 genotype was larger than the effect of each of these variables. The greater effect ranged from 3 times higher than hygiene to 34 times higher than maternal education, as measured by the beta coefficients observed in linear regression analyses (Table 2).

Results from contingency tables

Table 3 show the observed and expected counts for rs17822931 corresponding to each of the categories of deodorant usage. The results are presented for the genotype model (Tables 2 and 4) and for the recessive model (Supplementary Tables 1-3) for white mothers and both for white mothers and white partners according to children's rs17822931 genotype.

Mother genotype association with mother deodorant usage

Table 3A shows a significantly higher than expected frequency of the AA genotype in white mothers with a lower use of deodorant. There is a nearly 5-fold over-representation of AA individuals in the deodorant never use group, with significant over-representations in all other categories except in the category of daily deodorant usage. In this category, the observed frequency of AA homozygotes is significantly lower than that expected. Overall, there is significant ($P = 3.7 \times 10^{-20}$) difference between the observed and the expected numbers in the contingency table for deodorant usage and rs17822931 genotype. These results are very similar to the results observed under the recessive model (Supplementary Table 1).

The odds ratio (OR) (Table 3A) for AA vs GG (daily vs never) was OR=0.12, (95%CI=0.07-0.20) and, for AA vs GG (most days vs never), OR=0.38, (95%CI=0.21-0.70). The OR for GA vs GG (daily vs never) was OR=0.64 (95%CI=0.48-0.86).

Figure 1 shows the relation between rs17822931 genotypes and both an odoriferous steroid (data from (Martin *et al.*, 2010) and deodorant usage. AA homozygotes (with the lowest production of the odoriferous steroid) showed the highest ratio of never over daily deodorant usage. The converse was found for GG homozygotes. AG heterozygotes showed differences in relation to GG homozygotes, with both lower production of the odoriferous steroid and significantly (P=0.002) higher ratio of never over daily deodorant usage than GG homozygotes.

Child genotype association with mother deodorant usage

The results from the contingency table analysing white children's rs17822931 genotype by maternal deodorant usage (Table 3B and Supplementary Table 2) are different from the results observed in white mothers. There is an increased proportion of children with AA and GA genotype in the category of deodorant never use in white mothers. However, this increase is not as important as the one observed in white mothers deodorant usage according to their own rs17822931 genotype. Overall, there is significant (P = 0.010) difference between the observed and expected frequencies under the additive model (Table 3B) although these differences are not significant (P = 0.173) under the recessive model (Supplementary Table 2).

Odds ratio observed for GA vs GG (daily vs never) was OR=0.66, (95%CI=0.51-0.87) (Table 3B).

Child genotype association with partner deodorant usage

Table 3C and Supplementary Table 3 show partner's deodorant usage according to children rs17822931 genotype. No significant differences were observed in the contingency tests either under the additive model (P = 0.170) or under the recessive model (P = 0.263).

Odds ratio observed for GA vs GG (daily vs never) was OR=0.40, (95%CI=0.32-0.51) (Table 3C).

Mother genotype association with partner deodorant usage

Similar results were observed for the analyses of partner's deodorant usage stratified by maternal rs17822931 genotype (Supplementary Tables 4 and 5).

Prediction of parental deodorant usage based on child genotype

Supplementary Figure 2 shows the expected child genotype-parent phenotype associations based on parents' genotypes, allele frequency and proportions of never over daily use of deodorant for each genotypic category assuming a recessive model and restricting to white mothers. For maternal genotype-phenotype associations we found a good agreement between the observed ratios in children for each genotype and the liability predictions computed from parents.

Percentage of deodorant usage: mothers vs partners

The percentage of ALSPAC partners using deodorant daily or most days (82.7%) is significantly lower ($P = 5.3 \times 10^{-74}$) than the percentage for mothers using deodorant daily or most days (93.3%). The figures were computed from Tables 3A and 3C and are: 945 partners using deodorant about once/week or less, 4502 partners using it most days or daily; and 433 mothers using deodorant about once/week or less, 6062 mothers using it most days or daily.

Table 3A shows that 77.8% of women with the AA genotype still use deodorant (at least 1/week), compared with 80.0% of male parents of children with the AA genotype that use deodorant at least 1/week (Table 3C)

Table 2 also shows that, the proportion of women with the GG genotype that do not use deodorant (<1/week or never) is much reduced (4.7%), compared with 13.0% of male parents of children with the GG genotype that never use deodorant or use <1/week (Table 4).

Results in non-white ALSPAC participants

We performed, in non-white ALSPAC participants, similar analyses to those performed in white ALSPAC participants. Due to the lower number of subjects, we collapsed the five categories of deodorant usage into two distinct categories, never use of deodorant or <1 time/week *versus* >1 time/week. The results for all analyses are shown in Supplementary Tables 7-10. In summary, there was a strong ($P \sim 10^{-5}$) association between deodorant usage and rs17822931 genotype in non-white mothers and in non-white children according to

deodorant usage in mothers. In both instances, there was an excess of rs17822931 AA homozygotes in the never use of deodorant or <1 time/week (Supplementary Tables 7, 8). When non-white children genotype was analysed according to deodorant usage in mother's partners, there was still an excess of rs17822931 AA homozygotes in the never use of deodorant or <1 time/week, with an overall P=0.005 (Supplementary Table 9). A similar result was found when non-white mothers were analysed according to deodorant usage in partners, but P was 0.069 (Supplementary Table 10).